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and the rates of clocks depend in the first place on their gravitational fields, which again are produced by the material systems concerned.

Thus the new theory of gravitation diverges widely from that of Newton with respect to its basal principle. But in practical application the two agree so closely that it has been difficult to find cases in which the actual differences could be subjected to observation. As yet only the following have been suggested:

1. The distortion of the oval orbits of planets round the sun (confirmed in the case of the planet Mercury).

2. The deviation of light-rays in a gravitational field (confirmed by the English Solar Eclipse expedition).

3. The shifting of spectral lines towards the red end of the spectrum in the case of light coming to us from stars of appreciable mass (not yet confirmed).

The great attraction of the theory is its logical consistency. If any deduction from it should prove untenable, it must be given up. A modification of it seems impossible without destruction of the whole.

No one must think that Newton's great creation can be overthrown in any real sense by this or by any other theory. His clear and wide ideas will for ever retain their significance as the foundation on which our modern conceptions of physics have been built.

ALBERT EINSTEIN

SCIENTIFIC EVENTS

THE ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF STANDARDS

A REVIEW of the work of the National Bureau of Standards for the year ending June 30, 1919, is given in the alumni report of the director of the Bureau of Standards at Washington. The report describes the functions of the bureau in connection with standards and standardization, and contains a chart and description of the several classes of standards dealt with. The director also gives a clear idea of the relation of the bureau's work to the general public, to the industries, and to the government, and includes a special statement

of the military work of the year. Brief statements are made upon practically all of the special researches and lines of testing completed or under way at the bureau. The list of these topics occupies 12 pages in the table of contents.

The bureau is organized in 64 scientific and technical sections and 20 clerical, construction and operative sections. During the year the bureau has issued 51 publications, not including reprintings, 36 of which were new and 15 revisions of previous publications. In the several laboratories of the Bureau more than 131,000 tests were made during the year. The appropriations for the year, including special funds for war investigations, were approximately \$3,000,000. A noteworthy event of the year included the completion of the industrial laboratory in which will be housed the divisions having to do with researches and tests of structural materials. The building also includes a commodious kiln house for use, among other purposes, of the ceramics division in the experimental production of new clay products and for general experimental purposes.

The report comprises 293 pages and may be obtained as long as free copies are available by addressing the Bureau of Standards, Washington, D. C.

NEEDS OF THE COAST AND GEODETIC SURVEY

DECLARING that the work of the United States Coast and Geodetic Survey, which provides the navigating charts which are the direct means of protecting from loss the vessels of our navy, Coast Guard, and merchant marine, is seriously hampered by lack of funds, the superintendent of the survey makes an appeal for an adequate appropriation to remedy this situation, in his annual report to the secretary of commerce.

In order to make and put these navigational charts into the hands of all who demand them both the field and office forces must be kept up to the highest standards of efficiency, and this can not be done without sufficient funds to maintain and operate modern surveying vessels and obtain able officers and crews to man them. In addition

to the funds needed for the field work of the bureau, larger funds than are now available are required for carrying on the office work, for it is necessary to have highly trained men to prepare and care for the data used in making up these charts.

Lack of money prevents the bureau from obtaining a sufficient number of such men, and many of those at present in the service are leaving for better salaried positions elsewhere. There have been large numbers of resignations from the commissioned personnel and other scientific arms of the bureau, in fact, from all classes of the service, and it is expected that these conditions will continue until something is done to meet the situation.

The superintendent points out that the condition is so serious that it threatens to jeopardize public welfare, for, he says:

The commissioned officers are the lowest paid men of their training in the federal service. Their salaries, compared to those paid in the army and the navy for similar qualifications, are 30 to 50 per cent. less. Much of their work is more hazardous, requires special training, and takes them into all our country's possessions as the pioneer workers or navigators—surveyors who "blaze the trail" on land and sea. And no army or navy officer has greater qualifications, nor do they sacrifice more than the officer of the Coast and Geodetic Survey, yet the latter works for much the lowest salary, gets no longevity pay, no emoluments, and after he has given his best years to the service of his country he must retire without pay.

Too few persons realize the sacrifices a man of ability is making at the present time by remaining in the Coast and Geodetic Survey. Before this country entered the war conditions had grown to a serious stage, but since the signing of the armistice steady disintegration has gone on, and the situation has reached a point where the quality of the Survey's employees is declining principally under the stress of present economic conditions. Unless proper relief is forthcoming at once, and the present salaries are materially advanced, this important branch of the federal government, which has so much to do with the protecting of human lives, will, in a measure at least, be stripped of its best brains.

THE ROYAL MEDALS OF THE ROYAL SOCIETY

As has been noted in *SCIENCE* these medals were awarded to Professor John Bretland

Farmer and Mr. James Haywood Jeans. In conferring them on November 30 Sir Joseph Thomson, the president of the society, said:

Professor Farmer's work is characterized by the fundamental importance of the problems worked upon; thus his memoirs on the meiotic phase (reduction division) in animals and plants are of as great value to zoologists as to botanists, and his conclusions and interpretations of the complex nuclear changes which precede the differentiation of the sexual cells have stood the test of criticism, and remain the clearest and most logical account of these very important phenomena. His papers, in collaboration with his pupil, Miss Digby, on the cytology of those ferns in which the normal alternation of generations is departed from has thrown new light on problems of the greatest biological interest, and especially on the nature of sexuality. In his cytological work on cancerous growths Professor Farmer has established the close similarity between the cells of malignant growths and those of normal reproductive tissue.

Mr. Jeans has successfully attacked some of the most difficult problems in mathematical physics and astronomy. In the kinetic theory of gases he has improved the theory of viscosity, and, using generalized coordinates, has given the best proof yet devised of the equipartition of energy and of Maxwell's law of the distribution of molecular velocities, assuming the validity of the laws of Newtonian dynamics. In dynamical astronomy he took up the difficult problem of the stability of the pear-shaped form of rotating, incompressible, gravitating fluid at a point where Darwin, Poincaré and Liapounoff had left it, and obtained discordant results. By proceeding to a third order of approximation, for which very great mathematical skill was required, he showed that this form was unstable. He followed this up by the discussion of the similar problem when the fluid is compressible, and concluded that for a density greater than a critical value of about one quarter that of water the behavior is generally similar to that of an incompressible fluid. For lower densities the behavior resembles that of a perfectly compressible fluid, and with increasing rotation matter will take a lenticular shape and later be ejected from the edge.

MR. ROCKEFELLER'S GIFTS

THERE were announced on Christmas day two large gifts by Mr. John D. Rockefeller, \$50,000,000 to the Rockefeller Foundation and \$50,000,000 to the General Education Board, the money to be available for immediate use.